REMARKS

Claims 1 and 32–47 are pending in the present application.

Claims 1 and 38 were amended herein.

Reconsideration of the claims is respectfully requested.

35 U.S.C. § 103 (Obviousness)

Claims 1, 32, 35, 38–39 and 42 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,169,782 to *Katoh et al*. Claims 33 and 40 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Katoh et al* in view of U.S. Patent No. 4,110,899 to *Nagasawa et al*. Claims 34 and 41 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Katoh et al* in view of *Nagasawa et al* and further in view of JP 63-271956 to *Hosaka*. Claims 36–37 and 43–45 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Katoh et al* in view of *Nagasawa et al* and further in view of Wolf, *Silicon Processing for the VLSI Era*, vol. 2. These rejections are respectfully traversed.

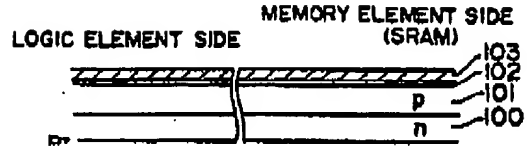
In *ex parte* examination of patent applications, the Patent Office bears the burden of establishing a *prima facie* case of obviousness. MPEP § 2142, p. 2100-133 (8th ed. rev. 4 October 2005). Absent such a *prima facie* case, the applicant is under no obligation to produce evidence of nonobviousness. *Id.*

To establish a *prima facie* case of obviousness, three basic criteria must be met: First, there must be some suggestion or motivation, either in the references themselves or in the knowledge

generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *Id.*

Independent claims 1 and 38 each recite forming channel stop implants of a second conductivity type in a first conductivity-type region masked by an overlying patterned photoresist previously used to pattern an active stack and expose isolation areas in the first conductivity-type region, then subsequently forming channel stop implants of the first conductivity type in a second conductivity-type region masked by a second, different overlying patterned photoresist previously used to pattern the active stack and expose isolation areas in the second conductivity-type region. The second patterned photoresist is formed directly on the exposed surface of the substrate in the isolation areas in the first conductivity-type region (i.e., no isolation oxide is grown between implants). Such a feature is not found in the cited references. *Katoh et al* teaches a substrate having a region for logic elements and a region for memory elements. In most of the embodiments disclosed in *Katoh et al*, both regions have the same conductivity type. In connection with these embodiments, *Katoh et al* discloses forming both the logic and memory elements on a n-type substrate 100 with a p-type epitaxial layer 101, an oxide 102 and a nitride 103:

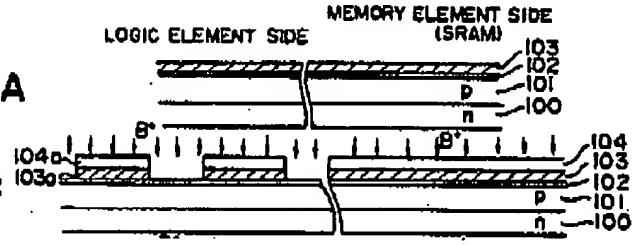
FIG.IA



Katoh et al, Figure 1A, column 3, line 67 through column 4, line 9. A resist 104 is formed on the oxide/nitride stack 102/103 and patterned to form patterned regions 104a over portions of the logic element side, which are used to form patterned nitride regions 103a on the logic element side:

FIG.IA

FIG.IB

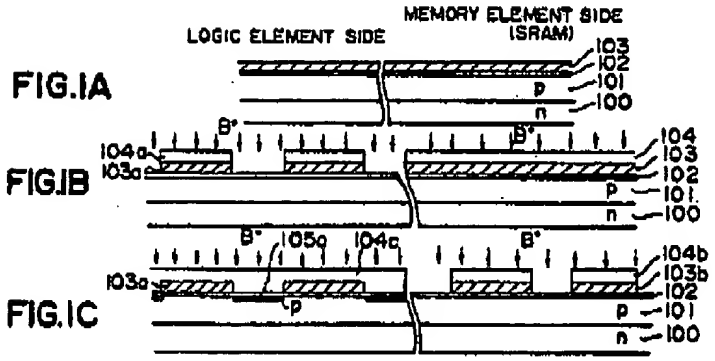


Katoh et al, Figure 1B, column 4, lines 9–21. Boron (a dopant of a first conductivity type) is implanted at a dose of 3×10^{13} atoms/cm^3 into exposed regions of the logic element side, masked by on the memory element side by photoresist 104 and nitride 103 and on the logic element side by the patterned photoresist 104a and nitride 103a. *Katoh et al*, column 4, lines 22–27. The photoresist 104, 104a is stripped and a new photoresist layer is formed and patterned, and used to pattern regions 103b in the nitride 103 on the memory element side:

FIG.1A

FIG.1B

FIG.1C

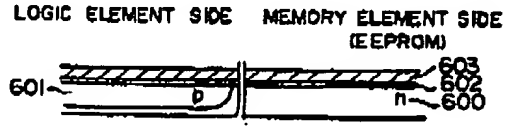


Katoh et al, Figure 1C, column 4, lines 28–37. The second resist 104c is depicted as formed directly on the gate oxide 102 for the isolation areas in the logic element region. Boron is then implanted into the memory element side at a does of 7×10^{13} atoms/cm^3. *Katoh et al*, column 4, lines 37–44.

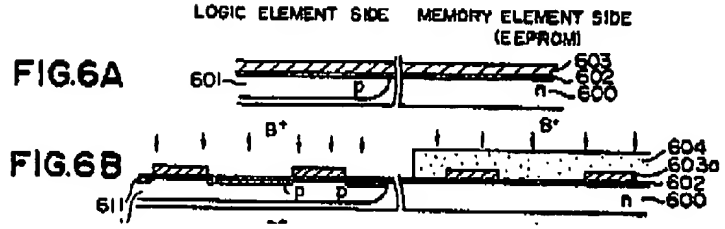
The principle embodiments disclosed in *Katoh et al* thus fail to teach or suggest at least (a) regions of opposite conductivity type, and (b) implanting channel stop dopants having into each of such opposite conductivity type regions having an impurity type opposite that of the region's impurity type as recited in the claims.

In one alternative process disclosed in *Katoh et al*, opposite conductivity-type wells are formed – specifically a low impurity concentration p-well 601 on the logic element side in a n-type substrate 600, on which an oxide 602 and nitride 603 are formed:

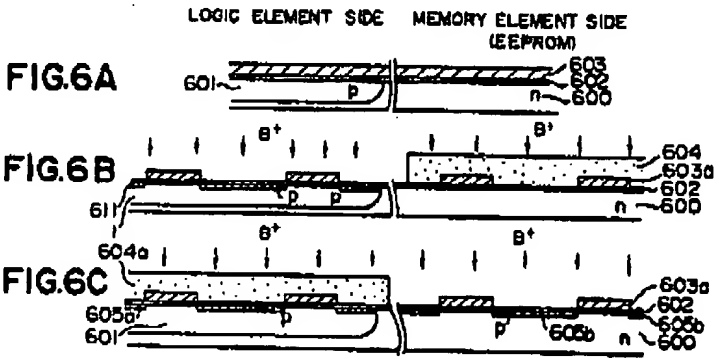
FIG.6A



Katoh et al, Figure 6A, column 7, lines 11–24. The oxide/nitride stack 602/603 is patterned:

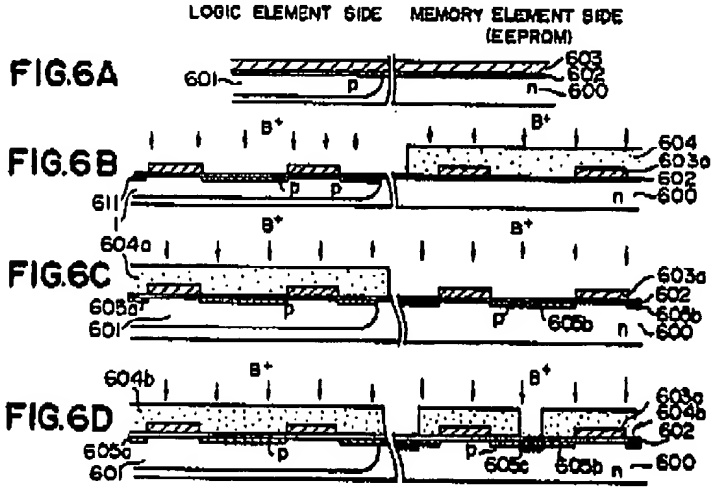


Katoh et al, Figure 6B, column 7, lines 25–29. Then a photoresist 604 is formed only on the memory element side and boron is implanted at a dose of 3×10^{13} atoms/cm^3 into exposed regions of the logic element side, masked only by the previously patterned nitride regions. *Katoh et al*, Figure 6B, column 7, lines 30–36. The photoresist 604 is stripped and another photoresist 604a is formed only on the logic element side:



Katoh et al, Figure 6C, column 7, lines 37–38. Boron is then implanted at a dose of 1.5×10^{13} atoms/cm^3 into exposed regions of the memory element side, masked only by the previously patterned nitride regions 603a. *Katoh et al*, Figure 6C, column 7, lines 39–43. The photoresist 604a

is stripped and a third photoresist 604b patterned with openings only over the central portions of the regions exposed by the patterned nitride 603a:



Katoh et al, Figure 6D, column 7, lines 44–49. Boron is then implanted at a dose of 5×10^{13} atoms/cm^3 into the memory element side, masked by the photoresist 604b. *Katoh et al*, Figure 6D, column 7, lines 50–53.

The alternative embodiment disclosed in *Katoh et al* thus fails to teach or suggest at least (a) masking channel stop dopant implantations using the same patterned photoresist layers employed in patterning the oxidation barrier, and (b) implanting channel stop dopants into each region having an impurity type opposite that of the region's impurity type as recited in the claims.

Neither of the embodiments disclosed in *Katoh et al* discloses all features recited in independent claims 1 and 38. Specifically, neither embodiment discloses implanting channel stop

dopants into both first and second conductivity type regions having an impurity type opposite that of the region's impurity type as recited in the claims. *Katoh et al* only teaches implanting p-type (boron) impurities, regardless of whether the region into which the impurities are implanted is p-type or n-type.

Moreover, each of the embodiments disclosed in *Katoh et al* fails to disclose additional features recited in the claims: either regions of opposite conductivity type (the principal embodiments) or masking channel stop dopant implantations using the same patterned photoresist layers employed in patterning the oxidation barrier (the alternative embodiment). The claimed invention can thus be reconstructed only by selective incorporation of features from one embodiment into the other embodiment.

No motivation exists for combining selected patterning steps from the two alternative processes as proposed in the Office Action, nor does the reference provide any reasonable expectation of success in such a selective combination.

The final Office Action states:

> [T]he test for obviousness is not whether the features of second embodiment may be bodily incorporated into the structure of the first embodiment; nor is it that the claimed invention must be expressly suggested in any one or all of the embodiment of the invention of Katoh et al. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642, F.2d 413, 208 USPQ 871 (CCPA 1981). In this case, as mentioned above, since both embodiments of the invention described in Katoh et al. Ends up at the same stage prior to the single oxidation step (Figs. 1C and 6C), it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable forming the isolation regions discloses in the second embodiment of the

> invention using the patterning process described in the first embodiment of the invention.

Paper No. 20060415, page 7. As an initial matter, however, the above-quoted language incorrectly states the applicable test for establishing a *prima facie* case of obviousness. According to the MPEP:

> [T]here must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings.

MPEP § 2143, page 2100-135 (8th ed. Rev. 4 October 2005). Stated differently:

> Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge generally available to one of ordinary skill in the art.

MPEP § 2143.01, page 2100-135. There are three possible sources for finding the requisite motivation or incentive to make the proposed combination:

> "There are three possible sources for a motivation to combine references: the nature of the problem to be solved, the teachings of the prior art, and the knowledge of persons of ordinary skill in the art." *In re Rouffet*, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998) (The combination of the references taught every element of the claimed invention, however without a motivation to combine, a rejection based on a prima facie case of obvious was held improper.). . . . .
>
> "In determining the propriety of the Patent Office case for obviousness in the first instance, it is necessary to ascertain whether or not the reference teachings would appear to be sufficient for one of ordinary skill in the relevant art having the reference before him to make the proposed substitution, combination, or other modification." *In re Linter*, 458 F.2d 1013, 1016, 173 USPQ 560, 562 (CCPA 1972).

MPEP § 2143.01, page 2100-135. To the extent that the Office Action is attempting to suggest that *Katoh et al* contains an "implicit" motivation or incentive to make the proposed invention:

> "The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art."

MPEP § 2143.01, page 2100-135. The Office Action fails to identify, from the teachings of *Katoh et al*, a problem to be solved that would have motivated the proposed combination. The problem addressed by the alternative embodiment disclosed in *Katoh et al* involves keeping the heavily doped portions of the inversion preventive layer on the memory element side away from the device formation regions, and only within the central areas of those regions:

> A fourth embodiment for forming an EEPROM as the memory element simultaneously with formation of a CPU will now be described. In this case, unlike the first to third embodiments, the field inversion preventive layer on the memory element side is formed in a manner that a portion adjoining the device formation region and a portion which does not adjoin it have impurity concentrations different from each other.
>
> . . . .
>
> As stated above, the semiconductor device is formed in a manner that the field inversion preventive layer on the logic element side and that on the memory element side have impurity concentrations different from each other. In the case of the field inversion preventive layer on the logic element side, this layer is formed so that it has a relatively low concentration impurity to prevent an unnecessary electric capacitor from being formed, thereby making it possible to prevent lowering of the operating speed.
>
> On the other hand, the field inversion preventive layer on the memory element side can be formed so that the portion adjoining the device formation region and the portion which does not adjoin it have concentrations different from each other. In this instance, the portion which does not adjoin the device formation region is formed so that it has ,an impurity concentration higher than that in the prior art. As seen from FIG. 8 showing the relationship between the field inversion voltage and the impurity concentration, a higher field inversion voltage can be thus provided. For this reason, even in the case where a high voltage is used, field inversion phenomenon can be prevented and the memory capacity of the memory element can be increased. In addition, by forming the portion adjoining the device formation

> region so that it has an impurity concentration lower than that of the field inversion preventive layer on the logic element side, the junction withstand voltage can be improved as compared to that of the prior art as seen from FIG. 9 showing the relationship between the junction withstand voltage and the impurity concentration.

Katoh et al, column 7, lines 3–10, column 7, line 62 through column 8, line 29. Nothing about that problem motivates incorporating the use of a different conductivity type region on the logic element side into the principal embodiments disclosed in *Katoh et al.*

The Office Action further states:

> Furthermore, Katoh et al. teach wherein the embodiments of the invention may be modified or altered in any form (Katoh et al., column 8, lines 30-31).

Paper No. 20060415, page 8. However, the mere fact that references can be combined or modified is not sufficient to establish *prima facie* obviousness:

> The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990) (Claims were directed to an apparatus for producing an aerated cementitious composition by drawing air into the cementitious composition by driving the output pump at a capacity greater than the feed rate. The prior art reference taught that the feed means can be run at a variable speed, however the court found that this does not require that the output pump be run at the claimed speed so that air is drawn into the mixing chamber and is entrained in the ingredients during operation. Although a prior art device "may be capable of being modified to run the way the apparatus is claimed, there must be a suggestion or motivation in the reference to do so." 916 F.2d at 682, 16 USPQ2d at 1432.). See also *In re Fritch*, 972 F.2d 1260, 23 USPQ2d 1780 (Fed. Cir. 1992) (flexible landscape edging device which is conformable to a ground surface of varying slope not suggested by combination of prior art references).

MPEP § 2143.01, page 2100-137.

The final Office Action essentially argues that the two embodiments are interchangeable, such that processing steps from either embodiment may be combined with or substituted for elements in the other embodiment:

> Since both embodiments of the invention ends up at the same stage prior to the single oxidation step (Figs. 1C and 6C) and furthermore, the embodiments of the invention may be modified or altered in any form (Katoh et al. column 8, lines 30-31), it would have been obvious to one of ordinary skill in the art at the time the invention was made to enable forming the isolation regions disclosed in the second embodiment of the invention using the patterning process described in the first embodiment of the invention.

Paper No. 20060415, page 4. This reasoning is not sufficient to establish a *prima facie* case of obviousness. As noted above, the mere fact that teaching can be modified or combined does not establish a *prima facie* case of obviousness. Moreover, the fact that the two processes "end[] up at the same stage prior to the single oxidation step" does not provide a motivation or incentive for using the patterning process of one during implantation of inversion preventive layers using the other embodiment. The mere fact that two processes produce the same end structure provides no suggestion that the processes may be combined, or that portions thereof may be interchanged.

The final Office Action further states:

> One of ordinary skill in the art at the time the invention was made would have been motivated to look to alternate the embodiments disclosed by Katoh et al. to form the above mentioned isolation regions because art recognized suitability for an intended purpose has been recognized to be motivation to combine. MPEP 2144.07.

Paper No. 20060415, page 8. However, as stated in the MPEP section above, the principle applies to selection of materials, not to processing steps:

> The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination . . .

MPEP § 2144.07, page 2100-151. The reasoning, applicable to materials with known properties, does not apply to processing steps. Nothing in *Katoh et al* suggests that the two processes are interchangeable, particularly given the differences in structure (e.g., patterning the nitride over both regions with a single patterning step before the implant steps rather than patterning the nitride with the same photoresist layers masking the impurity implantation). Moreover, since different implantations of impurities into different impurity-type regions (both into p-type regions in one embodiment but into one p-type and one n-type region in the other), at different dosages (5×10^{13} atoms/cm^3 in one embodiment and 1.5×10^{13} atoms/cm^3 in the other embodiment) and with different masking structures (both the patterned nitride and the photoresist in one embodiment but just the patterned nitride in the other embodiment, no inference can be drawn regarding the interchangeability of the two processes. In short, nothing in *Katoh et al* suggests that the extra processing steps required to form the p-type well on only the logic element side and not the memory element side, or the resulting structure, are conducive to use of a single patterned resist to both pattern the oxidation barrier and mask the channel stop dopant implant for both the logic and memory element sides.

Both embodiments in *Katoh et al* involve implanting the same channel stop dopant (boron) in both the logic element and memory element regions, not a first channel stop dopant in the first

isolation areas and a second channel stop dopant in the second isolation areas. The final Office Action states:

> [T]he claims fail to teach wherein specific dopants and wherein said first and second dopants are different.

Paper No. 20060415, page 9. Amended independent claims 1 and 38 recite use of different conductivity-type dopants to form the channel stops below the isolation regions of areas having different conductivity-types – that is, a p-type channel stop in the n-type well and an n-type channel stop in the p-type well.

Therefore, the rejection of claims 1, 32, 35, 38–39 and 42 under 35 U.S.C. § 103 has been overcome.

If any issues arise, or if the Examiner has any suggestions for expediting allowance of this Application, the Applicant respectfully invites the Examiner to contact the undersigned at the telephone number indicated below or at ***dvenglarik@munckbutrus.com.***

The Commissioner is hereby authorized to charge any additional fees connected with this communication or credit any overpayment to Deposit Account No. 50-0208.

Respectfully submitted,

MUNCK BUTRUS, P.C.

Date: 7-31-2006

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